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METHOD FOR DETERMINATION OF MICRONAIRE VALUE OF COTTON FIBRES

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METHOD FOR DETERMINATION OF MICRONAIRE VALUE OF COTTON FIBRES

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Indian Standard

METHOD FOR DETERMINATION OF MICRONAIRE VALUE OF COTTON FIBRES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 20 July 1966, after the draft finalized by the Textile Standards Sectional Committee had been approved by the Textile Division Council.

0.2 Fineness is one of the important characteristics of cotton fibre. The determination of fineness of cotton fibre by the gravimetric method as prescribed in IS : 234-1952* is time consuming. Therefore, several instruments using airflow method have been designed in US, UK and India, to determine the fineness values of cotton fibre indirectly.

0.3 The airflow instruments, generally prescribed for this method, operate on the principle that the rate of airflow, through a plug of cotton fibre of fixed weight contained in a container of definite dimensions and subjected to a constant pressure head is related to the fineness of the cotton fibre.

0.4 Much work on an international basis has been done to develop and make available a range of cottons for the calibration of airflow instruments. By use of these calibration cottons and application of the procedures prescribed in this standard, it is possible to achieve agreement between two laboratories within $\pm$ 0·2 micronaire units in the fineness measurement of the usual commercial sample of cotton.

0.5 When formulating this standard, the Committee concerned did not feel called upon to lay down a sampling procedure for drawing a bulk sample from material collected from the field, at the gin, the mill, the warehouse or the market. The bulk sample, it is expected, will be so as to be representative of the lot under investigation.

0.6 While formulating this standard considerable assistance has been derived from Doc: ISO/TC 38 (Secretariat — 270) 409 First draft proposal for an ISO Recommendation : Determination of micronaire value of cotton fibres issued by the International Organisation for Standardization.

0.7 In this standard generally metric units have been specified. However, where found necessary, to familiarize the industry with the metric values equivalent fps values have also been given.

*Method for determination of mean fibre weight per unit length (cotton).

0.8 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes a method for the determination of micronaire value of loose disorientated cotton fibres by means of airflow instruments. This standard is applicable to cotton taken from bales, laps, slivers or other sources of lint cotton.

2. PRINCIPLE

2.1 Air, under a specified pressure, is passed through a specimen of cotton of known weight confined to a space of known volume. The mass and volume of the specimen may be either constant or varied in relation to each other according to the type of instrument used. The resistance of the specimen to the flow of air is related to the average fineness of the fibres in the specimen. The rate of flow of air through the specimen, or the pressure difference across the specimen (according to the instrument used), is indicated on a scale graduated in either arbitrary units of micronaire value or appropriate absolute units.

3. TERMINOLOGY

3.0 For the purpose of this standard, the following definition shall apply.

3.1 Micronaire Value — A measure of the air permeability of a mass of cotton fibres under specified conditions expressed in terms of an arbitrary scale, called micronaire scale. The micronaire scale is based on a range of cottons to which micronaire values have been assigned by international agreement.

4. SAMPLING

4.1 Gross Sample — Take samples at random from different portions of the bulk sample to make up a **gross sample** weighing from 250 to 1 000 g.

NOTE — If the bulk sample weighs less than 250 g, the whole of it shall constitute the **gross sample.**

4.2 Test Sample — Spread the gross sample evenly on a level surface in the form of about 1 × 1 m square. Over this, place a metallic frame work of 1 × 1 m (inside dimensions) divided into 25 equal sub-squares. From each of these sub-squares, pull out at random approximately equal

*Rules for rounding off numerical values (*revised*).

bunches of fibres so as to get a sample weighing about 100 g. This shall constitute the **test sample.**

5. CONDITIONING OF TEST SAMPLE

5.1 The test sample shall be conditioned in standard atmosphere at 65 ± 2 percent relative humidity and 27° ± 2°C temperature for 4 hours (*see* IS : 196-1966*).

NOTE — Pre-conditioning of the test sample is not required.

6. ATMOSPHERIC CONDITIONS FOR TESTING

6.1 The test shall be carried out in standard atmosphere (*see* **5.1**).

7. APPARATUS

7.1 Balance — The balance shall be of sufficient capacity to weigh the specimen required for the airflow instrument used, and capable of weighing the specimen to an accuracy of 10 mg.

7.2 Airflow Instrument — It shall consist of the following principal parts:

a) Compression cylinder with perforated ends for the admission and discharge of air. The cylinder may be either of a known fixed volume or of variable volume but adjustable to known volume, and in either case, it shall have such dimensions that, with the prescribed weight of the specimen, each cubic centimetre of cylinder shall contain between 0·16 to 0·30 g of cotton when compressed.

b) One or more valves or other means for regulating and controlling the flow of air through, or the air pressure difference across the specimen.

c) A gauge or other means for measuring the resistance of the specimen to the airflow, or of the air pressure difference across the specimen. For example, a combination of a manometer for maintaining the air pressure applied to the specimen and a flowmeter for indicating the rate of airflow through the specimen may be used.

d) An air pump or other means for producing the required air pressure applied to the specimen, or the required pressure difference across the specimen.

8. ADJUSTMENTS AND CALIBRATION OF THE INSTRUMENT

8.1 Make preliminary adjustments appropriate to the instrument in use (*see* Appendices B, C, D and E).

*Atmospheric conditions for testing (*revised*).

8.2 Calibrate (*see* Appendix A) the instrument by testing at least three specimens from at least three calibration cottons.

8.2.1 The instrument shall be considered to be in calibration, if it reads the calibration cottons within $\pm$ 0·1 micronaire value of the established values for the corresponding calibration cotton. If the instrument does not read within these limits, either (a) re-adjust the instruments and repeat the calibration procedure, or (b) use an appropriate correction factor based on the ratio established during the calibration of the instrument.

9. PREPARATION OF TEST SPECIMENS

9.1 Open the test sample with the fingers, breaking up lumps if any, and eliminating as much of the extraneous matter as possible. Condition the test sample as prescribed in **5.1.**

9.2 Spread the opened, cleaned and conditioned test sample and divide it into 25 approximately equal groups. Extract small bunches of loose fibres from each group. Remove the pieces of non-fibrous material from fibres so collected and weigh at least two test specimens as in **9.3.**

9.3 The test specimens shall be of the size prescribed for the instrument being used. In instruments having compression cylinders of fixed volume, the weight of the specimen shall be within $\pm$ 0·5 percent of specimen weight appropriate for the instrument. In instruments having compression cylinders with adjustably varied volume, the weight of the test specimen used shall be known with an accuracy of $\pm$ 0·5 percent.

10. PROCEDURE

10.0 Make the necessary preliminary adjustments appropriate to the instrument used.

10.1 Place the test specimen in the fibre compression cylinder, a small portion at a time, taking care that all the fibres are placed inside.

10.2 Insert the compression plunger in position in the fibre compression cylinder and lock it.

10.3 Cause the air to flow through the specimen and read the airflow or the difference in pressure on the scale to an accuracy or half a division of the scale.

10.4 Remove the test specimen from the fibre compression cylinder. Open out the specimen and re-pack it into the fibre compression cylinder, taking care that all the fibres are placed inside. Determine one more test value of the specimen in the manner prescribed in **10.2** and **10.3.**

10.5 Take the other test specimen and determine the test values in the manner set out in **10.1** to **10.4**.

NOTE — If the deviation of any individual reading is more than 0·2 from the mean value, prepare two more test specimens as prescribed in **9** and find out the test values by the procedure prescribed in **10.1** to **10.5**.

11. CALCULATION AND EXPRESSION OF RESULTS

11.1 In instruments in which the scale is graduated in micronaire units, find the average of the test values to the nearest 0·1 micronaire unit and report it as the micronaire value of the cotton fibre in the lot.

11.2 For instruments in which the scale is graduated in units other than micronaire, convert the direct reading to micronaire units either from a previously prepared graph or by previously fitted curve (*see* **A-3.1**). Find the average of the values thus obtained to the nearest 0·1 micronaire unit and report it as the micronaire value of the cotton fibre in the lot.

NOTE — A conversion curve or a conversion equation will have to be prepared for all instruments not having a micronaire scale in order to make full use of the calibration cottons referred to in Appendix A.

12. REPORT

12.1 The test report shall include the following:

a) the average value calculated as the micronaire value of the lot;

b) the type, make and model of instrument used; and

c) the number of specimens tested.

APPENDIX A

(*Clause* 8.2 *and* Note *under* 11.2)

METHOD OF CALIBRATING AIRFLOW INSTRUMENTS

A-1. CALIBRATION COTTONS

A-1.1 Secure calibration samples of the International Calibration Cottons series from the Cotton Division, Agricultural Marketing Service, United States Department of Agriculture, Washington 25, D. C., USA. These are furnished with micronaire values established by the International Calibration Cotton Standards Committee. Currently, there are nine such cottons. They approximately cover the range of micronaire values of the

world's commercial cottons. Secondary calibration cottons series, corresponding to the International Calibration Cottons series, are proposed to be prepard in India.

A-2. CALIBRATION OF INSTRUMENTS WITH SCALE GRADUATED IN MICRONAIRE UNITS

A-2.1 For an airflow instrument equipped with a micronaire scale, use a minimum of two specimens from each of three of the calibration cottons when calibrating the instrument. Make two test determinations on each specimen, the second determination serving to check the first. The difference between the first and second readings on a test specimen shall not exceed 0·1 micronaire unit.

A-2.2 In instances where the difference between the two readings exceeds 0·1 micronaire unit, prepare a new specimen of the calibration cotton and make two readings on it. Continue such readings until two specimens from calibration cotton have each been read within the tolerance specified.

A-2.3 Find the average of the first readings of the three specimen and compare with the established value printed on the label of the calibration cotton. If none of the differences between the averages and the corresponding established values exceed 0·10 micronaire unit, the instrument is considered to be in calibration. If greater differences occur, make necessary adjustments in the instrument to bring it into compliance with established values of the calibration cottons. Alternatively, calculate a series of corrections to be applied to the readings of the cottons to be tested.

A-3. CALIBRATION OF INSTRUMENTS WITH SCALE GRADUATED IN OTHER THAN MICRONAIRE UNITS

A-3.1 For an airflow instrument equipped with scale graduated in other than micronaire units, establish the relation between the instrument readings and the established micronaire values for the calibration cottons by plotting a graph or fitting a curve. It is recommended to use as many calibration cottons as available preferably more than three.

APPENDIX B

(*Clause* 8.1)

OPERATION OF THE MICRONAIRE AIRFLOW INSTRUMENTS*

B-0. GENERAL

B-0.1 There are several models of the micronaire instrument which vary only in details of construction and operation intended to increase safety,

*Mention of the name of a specific (or proprietary) instrument is not intended to promote or give preference to the use of that instrument.

ease and speed of operation. For any other operational or constructional details not given here, the manufacturer's instructions supplied with the instrument shall be consulted.

B-1. MICRONAIRE 60600 MODEL

B-1.1 Adjust and calibrate the instrument mechanically as follows.

B-1.1.1 Set the primary air regulator to a pressure of 1·75 kg/cm² (25 lb/in²) and open the shut-off valve that admits air to the instrument.

B-1.1.2 Insert the manometer plug in the compression cylinder, allow the air to enter and adjust the secondary air regulator so as to obtain a pressure of 0·42 kg/cm² (6 lb/in²) in compression cylinder. Again, if necessary, after the air flows through the instrument, re-adjust the regulating valve.

B-1.1.3 Insert one of the master orifice plugs, allow the air to enter, and if necessary, turn the calibration screw to bring the float to the position on the curvilinear scale corresponding to the designation of the orifice plug. Repeat these operations, using the other orifice plug or disc (*see* Notes 1 *and* 2).

NOTE 1 — Instead of two calibration discs, each with its bore, one disc with two different bores may be used. If the latter is used, close one of the bores with a finger at the lower scale value of 2·8, the bore to be closed being especially marked.

NOTE 2 — The scale readings 2·8 and 6·2 respectively correspond to flow rates of 21·1 ± 0·8 litre/min (0·75 ± 0·03 ft³/min) and 49·3 ± 1·4 litre/min (1·74 ± 0·05 ft³/min).

B-2. MICRONAIRE 80400 MODEL

B-2.1 Adjust and calibrate the instrument mechanically as follows.

B-2.1.1 Operate the foot valve and see that the air pressure behind the filter is between 4·2 kg/cm² (60 lb/in²) and 8·8 kg/cm² (125 lb/in²).

B-2.1.2 Open the pressure regulator and the upper and lower adjusting valves, as far as possible.

B-2.1.3 Insert the control disc in the test chamber, open the foot valve. Operate the pressure regulator so that the mercury column rises to 0·31 kg/cm² (4·4 lb/in²), that is, to three scale units below the red line. The air shall pass through both bores of the control disc without hindrance.

NOTE — Operate the valve several times and see that the mercury always rises to the same height.

B-2.1.4 Adjust the upper edge of the float against micronaire value of 4·6 by regulating the lower adjusting valve.

B-2.1.5 Adjust the upper edge of the float approximately to micronaire value of 6·0 (upper check mark) by regulating the upper adjusting valve.

B-2.1.6 Tightly close the upper opening of the control disc with one finger. The float will then fall to about the level of lower check mark.

B-2.1.7 In order to make an exact adjustment, while alternately opening and closing the upper opening of the control disc, alternately change the lower and upper adjusting valves. Do this until the upper edge of the float corresponds with the two check marks located at about micronaire values of 2·9 and 6·0.

B-2.1.8 Turn the pressure regulator until the mercury column stands at 0·33 kg/cm² (4·7 lb/in²).

B-2.1.9 By opening and closing the upper opening of the control disc, check whether the upper and lower positions of the float still correspond with the two adjustment marks even after the change of the mercury column from 0·31 kg/cm² (4·4 lb/in²) to 0·33 kg/cm² (4·7 lb/in²). If this does not occur, repeat the procedure as given in **B-2.1.7.**

NOTE — Open and close the upper opening of the control disc, several times. If the adjustments were correctly made, the float position shall correspond to both marks without further changes of the adjusting valves.

B-3. CALIBRATION AND TESTING

B-3.1 After adjusting the instrument mechanically (**B-1.1.1** to **B-1.1.3** *or* **B-2.1.1** to **B-2.1.9**, depending upon the instrument used), check the instrument with at least three International Calibration Cottons (*see* Appendix A). Repeat the check with the calibration cottons at frequent intervals.

B-3.2 Follow the instructions given in **4**, **5** and **9** for sampling, conditioning of samples and preparation of specimens to be tested.

NOTE — The test specimen shall weigh 3·24 g ±0·5 percent (50 grains ±0·5 percent).

B-3.3 Follow the instructions given in **10.1** to **10.5** for loading the specimen, closing the compression cylinder, and reading the gauge.

B-3.4 Follow the instructions given in **11.1** and **11.2** for calculating and reporting the test result.

APPENDIX C

(*Clause* 8.1)

OPERATION OF THE W.I.R.A. FINENESS METER (COTTON MODEL)*

C-0. GENERAL

C-0.1 There are two models of the W.I.R.A. Fineness Meter (Cotton Model) described as the 'old model' and 'new model' respectively. They differ primarily in the scale units and size of test specimen used. The old model is graduated in litres per minute and measures a specimen weighing 6·0 g. The new model is equipped with a scale graduated in micronaire units and measures a specimen weighing 5·0 g. For any other constructional or operational details not given here, the manufacturer's instructions supplied with the instrument shall be consulted.

C-1. ADJUSTMENT OF THE INSTRUMENT

C-1.1 For preliminary calibration, adjust the instrument until the level of the liquid in the manometer tube coincides with the upper 'zero' mark.

NOTE — The lower edge of the meniscus is observed when noting the length of the liquid column.

C-2. CALIBRATION AND TESTING

C-2.1 After preliminary adjustment, calibrate the instrument by using at least three International Calibration Cottons (*see* Appendix A).

C-2.2 Follow instructions given in **4**, **5** and **9** for sampling, conditioning of samples and preparation of specimens to be tested.

NOTE — The test specimen for the old model W.I.R.A. shall weigh 6·0 g ±0·5 percent; and for the new model, it shall weigh 5·0 g ±0·5 percent.

C-2.3 Follow instructions given in **10.1** to **10.5** for loading the specimen, closing the compression cylinder, and reading the gauge.

C-2.4 Follow instructions given in **11.1** and **11.2** for calculating and reporting results.

*Mention of the name of a specific (or proprietary) instrument is not intended to promote or give preference to the use of that instrument.

APPENDIX D

(*Clause* 8.1)

OPERATION OF THE ATIRA FIBRE FINENESS TESTER*

D-0. GENERAL

D-0.1 The instrument developed by the Ahmedabad Textile Industry's Research Association (ATIRA) measures the 'Micronaire value' Mc and 'Maturity fineness' MH of cottons on two separate scales. Cotton having Mc values in the range of 2·5 to 6·5 or MH values from 1·5 to 7·0 may be tested on this instrument. Mc value is the micronaire value and MH value is the product of the maturity ratio and the fineness in micrograms per inch as obtained by weighing whole fibres. For any other constructional or operational details not given here, the manufacturer's instructions supplied with the instrument shall be consulted.

D-1. ADJUSTMENT OF THE INSTRUMENT

D-1.1 Level the instrument accurately with the levelling screws provided.

D-1.2 Check the level of the liquid in the manometer. The level shall coincide with the reference mark on the initial vertical portion of the manometric scale. If the level is lower, open the reservoir and top up with the provided manometric liquid.

D-1.3 Squeeze the aspirator bulb, so that the float in the air tank rises to the top. As the float descends, gently close the fibre compression cylinder with the rubber stopper. See that the level of the manometer liquid stays between the limits marked on the final vertical section of the scale.

D-2. CALIBRATION AND TESTING

D-2.1 After preliminary adjustment calibrate the instrument by using the International Calibration Cottons (*see* Appendix A).

D-2.2 Follow the instructions given in **4**, **5** and **9** for sampling, conditioning of samples and preparation of specimens to be tested.

NOTE — The test specimen shall weigh 5·0 g ± 0·5 percent.

D-2.3 Follow the instructions given in **10.1** to **10.5** for loading the specimen, closing the compression cylinder and reading the gauge.

D-2.4 Follow the instructions given in **11.1** and **11.2** for calculating and reporting the test result.

*The ATIRA Fibre Fineness Tester is available at Ahmedabad Textile Industry's Research Association, Navrangpura, Ahmedabad-9. Mention of the name of a specific (or proprietary) instrument is not intended to promote or give preference to the use of that instrument.

APPENDIX E

(Clause 8.1)

OPERATION OF PORT-AR FIBRE FINENESS TESTER*

E-0. GENERAL

E-0.1 It is a portable Arealometer meant for use at places where the cotton is traded or processed. It is graduated in 'equivalent fibre thickness' in microns and micronaire units. The two scales are graduated from 3 to 7 microns and 2·5 to 7 micronaire units respectively. It measures a specimen of 8·0 g. It can be read to an accuracy of $\pm$ 0·05 micronaire unit. For any other constructional or operational details, not given here, the manufacturer's instructions supplied with the instrument shall be consulted.

E-1. ADJUSTMENT OF THE INSTRUMENT

E-1.1 Place the instrument on a level surface and remove the cover. Check the zero of the permeability indicating meter.

E-1.2 Place a weight of 8 g on the weighing scale and with the compression lever in the top position, adjust the zero screw until the permeability indicating meter reads near the red mark on the scale.

E-1.3 Take approximately 8·0 g of cotton and place on the weighing scale. Give one stroke to the pump of the atomizer bulb and see whether the specimen is heavier or lighter than 8·0 g. If the indicator goes above the red mark, the specimen is heavier and if it goes below, the specimen is lighter. By taking off or adding bit by bit, adjust the specimen weight to 8·0 g.

E-2. CALIBRATION AND TESTING

E-2.1 After preliminary adjustment calibrate the instrument by using the International Calibration Cottons (*see* Appendix A).

E-2.2 Follow the instructions given in **4**, **5** and **9** for sampling, conditioning of samples and preparation of specimens to be tested.

NOTE — The test specimen shall weigh 8·0 $\pm$ 0·5 percent.

E-2.3 Follow the instructions given in **10.1** to **10.5** for loading the specimen, closing the compression cylinder and reading the gauge.

E-2.4 Follow the instructions given in **11.1** and **11.2** for calculating and reporting the test result.

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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